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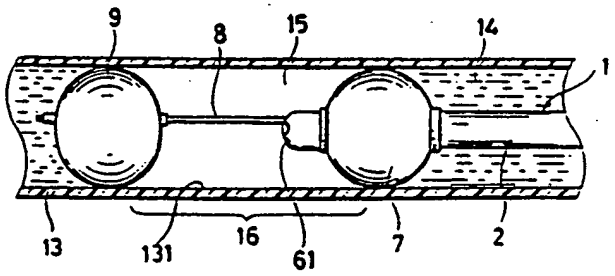
(54) CATHETER TUBE AND ENDOSCOPE.

(57) When an observation unit is attached to a catheter tube having a first inflatable balloon on a tube body and a second balloon which is set uninflated in the tube body and can be extended from the tube body to be inflated, the catheter tube can be used as an endoscope for observing the interior of a body cavity and giving a medical treatment thereto from a position outside the body. This tube is capable of defining an observation space of an arbitrary length between the first and second balloons, and preventing the entry of a body fluid, such as blood, thereinto. This enables a transparent visual field to be obtained.

FIG. 6



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In displacing the blood in this manner, it has been customary to inflate a balloon formed around the outer periphery of the tube to interrupt the blood flow, to eject the transparent liquid, such as physiological saline, into the region to be observed to displace the blood and to cause the region to be filled with the transparent liquid.

However, with this method, blood flow reversal may be caused in the course of the observation in the artery, while the blood tends to flow into the transparent field of view by way of branching sites of the blood vessel ahead and at back of the balloon, so that the transparent field of view cannot be obtained stably.

Disclosure of the Invention

It is an object of the present invention to solve the above mentioned deficiency of the prior art and to provide a catheter tube adapted to prevent blood inflow to the target site in the blood vessel and an endoscope making use of the catheter tube.

This object may be achieved by the present invention.

Thus the present invention provides a catheter tube characterized in that the catheter tube comprises a tube main body,

an inflatable first balloon placed around an outer peripheral wall of the tube in the vicinity of a distal end of the tube main body,

a lumen formed in said tube main body, said lumen communicating with the inside of said first balloon and opening into the foremost part of the tube main body, and

a tubular member accommodated within said lumen, said tubular member having an inflatable second balloon in the vicinity of the distal end thereof and a passage communicating with the interior of said second balloon,

wherein said tubular member moves axially within said lumen with said second balloon remaining in the deflated state so that said second balloon can be moved to a position spaced a predetermined distance from the distal end of said tube main body.

The above described catheter tube of the present invention is preferably a catheter tube for blood vessel.

The present invention also provides an endoscope in which the tube main body of the catheter tube is provided with a lumen adapted for accommodating an instrument for observation and the instrument of observation is accommodated within the lumen.

Brief Description of the Drawings

Fig. 1 is a partial longitudinal cross-sectional view showing a constructional example of the catheter tube and the endoscope according to the present invention.

Fig. 2 is a cross-sectional view taken along line II - II of Fig. 1.

polyethylene terephthalate, for example, and may be inflated or deflated freely.

The tube main body 2 is formed of a flexible material, such as PVC, polyurethane, silicone rubber, PE, nylon or EVA.

The tube main body 2 is formed with various lumens of different usages and functions, as will be explained subsequently.

A first lumen 3 communicates with the first balloon 7 via a side hole 31 for supplying an actuating fluid, which may be a gas or a liquid, into the first balloon 7 to inflate the first balloon 7, or discharging the actuating fluid out of the first balloon 7 to deflate the first balloon 7.

The first balloon 7 is adapted to be contacted tightly with the inner wall surface of the body cavity into which the catheter is introduced, when the balloon is inflated, and plays the role of securing the catheter tube 1 with respect to the body cavity and the role of displacing the blood obstructing the field of view ahead of the first balloon 7 or towards the distal end of the tube main body and of interrupting blood inflow into the field of view during blood replacement by a transparent liquid.

Preferably, the first balloon 7 is adapted to be inflated radially from the center of the tube main body 2.

Although the first balloon 7 may be of a circular, elliptical or similar cross-section, it is preferably of a

wall of the tubular member 8 for establishing communication between the passage 81 and the inside of the second balloon 9. The second balloon 9, which may be inflated and deflated freely, is mounted around the outer peripheral wall of the foremost part of the tubular member 8 for covering the side hole 82 and, when the actuating fluid is supplied from the proximal end of the tubular member 8 into the passage 82, the actuating fluid flows into the second balloon 9 via passage 81 and side hole 82 to inflate the second balloon 9 as indicated by broken lines in Fig. 3.

Similarly to the above-mentioned first balloon 7, the second balloon 9 is also adapted to be contacted, when inflated, with the inner wall surface of the body cavity into which the catheter tube 1 is introduced, and plays the role of interrupting blood influx into the field of sight when the transparent liquid is substituted for blood. The constituent material and the shape as well as mounting means for the second balloon 9 are the same as those explained with reference to the above-mentioned first balloon 7.

The constituent material for the tubular member 8 may be arbitrarily selected provided that these are soft and pliable while being excellent in torque transmitting properties. Examples of these materials include metals such as nickel-titanium alloys, stainless steel or platinum and various plastics such as polypropylene, vinyl chloride or nylon. Of

be introduced into or sucked out of the body cavity. More specifically, the third lumen 5 may be used for administering a liquid drug or the like into the body cavity in which the catheter tube 1 has been inserted and retained, or may be used as a flushing channel by means of which a transparent liquid, such as a physiological saline, for displacing the blood otherwise obstructing the field of view at the time of observation of the inside of the blood vessel by the endoscope.

A fourth lumen 6 is opened at the foremost part of the tube main body 2, and a bundle of optical fibers, as an instrument for observing within the fourth lumen for constituting the endoscope of the present invention.

This optical fiber bundle is constituted by light transmitting fibers or a light guide 10 and light receiving fibers or imaging fibers 11, with the foremost part of the optical fibers lying in the vicinity of an end opening 61 of the fourth lumen 6. A lens 12 is attached to the foremost part of the optical fibers 10, 11.

The light radiated from a light source, not shown, at the proximal end of the catheter tube 1 towards the right-hand side of Fig. 1, is transmitted within the inside of the light transmitting optical fibers 10 so as to be irradiated on the site of observation via the forward end of the optical fibers. The reflected light is introduced at the foremost

Lumens : four lumens

First Balloon inflating Lumen (inside diameter, 0.3 mm)

Tubular Member Accommodating Lumen (inside diameter, 1.0 mm) (lubricated by silicone coating)

Transparent Liquid Ejecting Lumen (inside diameter, 0.3 mm)

Fiber Accommodating Lumen (inside diameter, 0.8 mm)

First Balloon

Constituent Material : Latex Rubber

Thickness : 0.1 mm

Shape : Cylindrical

Effective Length : 7 mm

Diameter of Inflatable Section : 1.9 mm (on deflation) and 6 mm (on inflation)

Second Balloon

Constituent Material : Latex Rubber

Thickness : 0.1 mm

Shape : Cylindrical

Effective Length : 7 mm

Diameter of Inflatable Section : 0.6 mm (on deflation) and 6 mm (on inflation)

Tubular Member

Constituent Material : ultraelastic alloy (composition : nickel·titanium)

Outside Diameter : 0.46 mm

Inside Diameter of Passage : 0.2 mm

balloon and syringes B and C are connected thereto to enable the fluid for inflation, such as CO_2 gas, to be injected into each of the balloons.

The above described endoscope was inserted as far as the target site in the blood vessel with the inside diameter of approximately 5 mm. The tubular member remained in the state in which it was introduced into the lumen up to the position is which the second balloon was contacted with the end face of the tubular main body.

The syringe B was first actuated for injecting the CO_2 gas for inflating the first balloon to secure the endoscope with respect to the blood vessel as well as to interrupt the blood stream.

The tubular member was then gripped and moved towards the distal end of the tube until the distance of approximately 30 mm was reached between the first and the second balloons. The syringe A was then actuated for injecting 5 ml of physiological saline into the blood vessel ahead of the first balloon (at the forward side end) while displacing the blood and charging the physiological saline.

The syringe C was then actuated for injecting the CO_2 gas for inflating the second balloon into tight contact with the inner wall of the blood vessel.

In this state, a transparent liquid 15, such as physiological saline, is ejected via opening 51 at the foremost part of the tube and via third lumen 5 for thrusting and displacing the blood ahead of the first balloon (towards the foremost part) for substitution thereof by the transparent liquid 15.

Then, as shown in Fig. 5, the tubular member 8 accommodated within the second lumen 4 is moved towards the forward side of the tube so that the second balloon 9 attached to the foremost part of the tubular member 8 in the deflated state is placed at a position which is more forward than the observation site and which is spaced a predetermined distance from the foremost part of the tube main body 2. It is noted that ejection of the transparent liquid 15 and movement of the tubular member 8 may be effected simultaneously or in the sequence which is reversed from the above described sequence.

Then, as shown in Fig. 6, the actuating fluid is supplied via passage 81 of the tubular member 8 into the second balloon 9 for inflating the second balloon 9 into tight contact with the inner wall surface 131 of the blood vessel 13. In this state, the transparent field of view 16 filled with the transparent liquid 15 is defined in a region between the first balloon 7 and the second balloon 9 within the blood vessel 13 to permit the inside of the blood vessel

cavity and therapeutic treatment may be performed within a space in the body cavity delimited by the first balloon and the second balloon, so that, when the inside of the blood vessel is observed by a fiberscope, by way of an example, a clear image can be viewed for a prolonged time, without the blood obstructing the field of view flowing into the transparent field of view (observation site) defined between the first balloon and the second balloon.

On the other hand, since the tubular member provided with the second balloon may be moved along the axis of the catheter, the region from which to take the clear view may be selected in a desired manner.

In addition, the tubular member provided with the second balloon may also be used as the guide wire, in which case a dedicated guide wire need not be inserted previously but the catheter tube may be inserted once and for all to relieve the patient of unnecessary pain.

(4) A catheter tube characterized in that the catheter tube comprises tube main body,

an inflatable first balloon place around an outer peripheral wall of the tube in the vicinity of a distal end of the tube main body,

a lumen formed in said tube main body, said lumen communicating with the inside of said first balloon and opening into the foremost part of the tube main body, and

a tubular member accommodated within said lumen, said tubular member having an inflatable second balloon in the vicinity of the distal end thereof and a passage communicating with the interior of said second balloon,

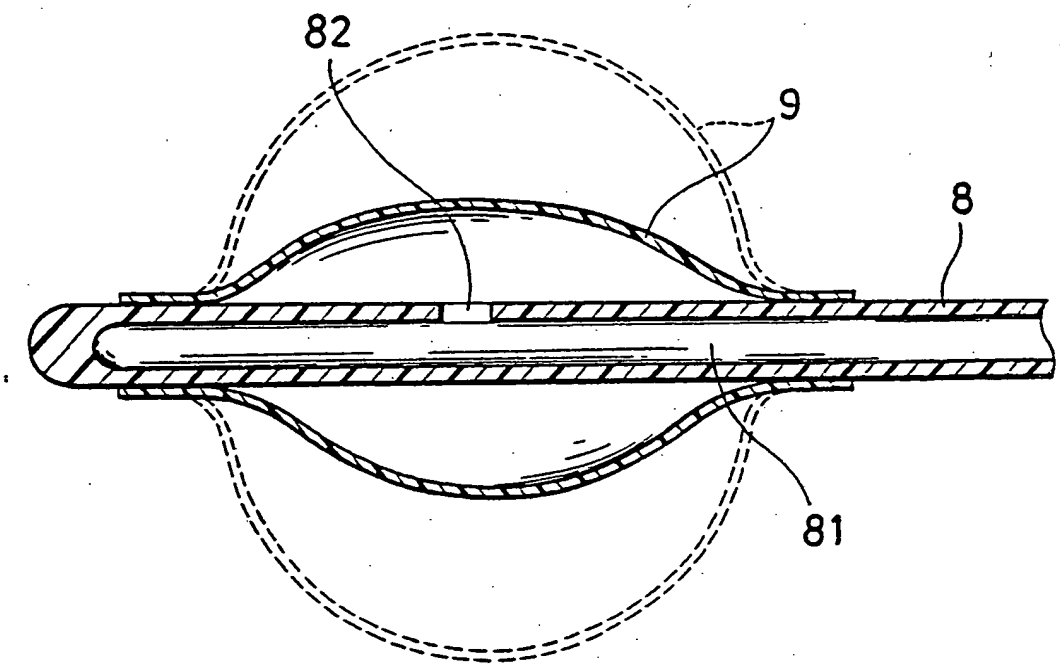
wherein said tubular member moves axially within said lumen with said second balloon remaining in the deflated state so that said second balloon can be moved to a position spaced a predetermined distance from the distal end of said tube main body.

(5) The catheter tube according to any one of claims 1 to 4, wherein said catheter tube is a catheter tube for blood vessel.

(6) An endoscope characterized in that the tube main body of the catheter tube according to any one of claims 1 to 5 is provided with a lumen adapted for accommodating an observation instrument, and the observation instrument is accommodated within said lumen.

(3) The catheter tube according to claims 1 or 2, wherein said tubular member is used as the guide wire for said catheter tube.

FIG. 3



INTERNATIONAL SEARCH REPORT

International Application No PCT/JP89/00134

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl[4] A61B1/00

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	A61B1/00, A61M25/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

Jitsuyo Shinan Koho	1969 - 1989
Kokai Jitsuyo Shinan Koho	1971 - 1989

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X, Y	JP, A, 51-11689 (Fuji Photo Optical Co., Ltd.) 29 January 1976 (29. 01. 76) Page 1, lower right column, line 8 to page 2, upper left column, line 15 (Family: none)	1
Y	JP, A, 59-181121 (Olympus Optical Co., Ltd.) 15 October 1984 (15. 10. 84) Page 3, lower left column, line 8 to lower right column, line 6 (Family: none)	3, 5

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
April 26, 1989 (26. 04. 89)	May 15, 1989 (15. 05. 89)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	